The Effect of Air Currents on the Behaviour of the Indian Stick Insect *Carausius morosus* (Br.)

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It has long been known that some stick insects exhibit curious side to side swaying movements and that they can be stimulated to perform these movements by being blown on. The reasons for such movements are still far from clear, although Rupprecht (1971) claimed to have established that these movements were both a method of adjusting body temperature and a deterrent to predators. My observations render the first hypothesis unlikely, whilst anyone wishing to locate the otherwise completely camouflaged individuals of *C. morosus* has merely to breathe gently on the vegetation which contains them.

In the following experiments a colony of *C. morosus* was kept in a glass cage with a gauze top through which air currents could be directed. The air currents were provided by an electric fan blowing air over a grid of constantan heater wire. I was thus able to subject the insects to a variety of temperatures and to three different air speeds. The temperatures quoted below were measured at the top of the cage, i.e. at the nearest point to the heater.

The colony was subjected to 15 different conditions (all possible combinations of three air speeds and five different air temperatures) and the results are most concisely expressed in grid form. In this grid each row represents a constant air speed and each column a constant air temperature, so that the sums of the rows and columns express the behaviour with only one variable. The grids are set up as follows:

...	...	...	...	...	slow current
...	...	...	...	...	medium current
...	...	...	...	...	fast current
20°	25°	30°	35°	40°	

I distinguished 22 patterns of behaviour:

A. Movement of the fore limbs; these often waving.

4	5	3	2	3	17
4	3	6	4	3	20
5	3	5	4	3	20
13	11	14	10	9	

B. Movement of one hind limb only.

3	2	1	1	0	7
1	3	1	1	0	6
0	1	1	1	1	4
4	6	3	3	1	

C. Arching of the end of the abdomen.

2	2	5	6	2	17
3	4	5	3	2	17
4	7	3	3	2	19
9	13	13	11	6	

D. Swaying from side to side with six limbs anchored.

1	7	9	6	3	26
1	4	10	9	4	28
3	5	8	7	3	26
5	16	27	22	10	

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E. Swaying from side to side with four limbs anchored, the front limbs extended.

6	5	5	8	1	25
4	1	7	7	5	24
5	2	8	2	5	22
15	8	20	17	11	

D/E. Data for both forms of swaying combined.

7	12	14	14	4	51
5	5	17	16	9	52
8	7	16	9	8	48
20	24	47	39	14	

F. Slight antennal movement.

9	2	2	0	0	13
5	3	1	0	0	8
3	1	0	0	0	4
17	6	3	0	0	

G. Slight swaying backwards and forwards, with fore limbs waving.

0	1	0	2	0	3
0	1	3	3	0	7
1	0	3	1	1	7
1	2	6	6	1	

H. Movement of the hind abdomen.

3	1	0	1	0	5
1	3	1	0	0	5
1	0	0	0	0	1
5	4	1	1	0	

I. Rapid climbing on twigs, using all limbs.

1	2	4	1	1	9
1	0	1	1	3	6
0	1	1	3	1	6
2	3	6	5	5	

J. Rapid climbing on twigs, using four limbs, the front limbs often waving.

0	0	5	0	1	6
1	0	2	1	5	9
0	0	1	1	0	2
1	0	8	2	6	

I/J. Data for both forms of climbing combined.

1	2	9	1	2	15
2	0	3	2	8	15
0	1	2	4	1	8
3	3	14	7	11	

K. Rapid descent to the bottom of the cage.

3	4	6	11	10	34
5	6	4	14	6	35
9	5	8	11	2	35
17	15	18	36	18	

L. Rapid movements on the base of the cage.

0	4	0	1	3	8
0	0	1	3	1	5
1	4	3	2	4	14
1	8	5	6	8	

M. Ascending to the top of the cage, and then swaying as in D.

2	3	5	3	1	14
3	6	6	5	0	20
1	3	3	1	0	8
6	12	14	9	1	

N. Rapid ascent and descent on the sides of the cage.

0	0	0	0	1	1
0	0	0	0	0	0
1	0	0	1	1	3
1	0	0	1	2	

O. Waving one leg only.

P. Moving to a region of best shelter from the air current.

4	6	2	5	0	17
7	7	1	0	0	15
1	5	1	0	0	7
12	18	4	5	0	

1	2	1	4	10	18
0	1	0	1	13	15
2	3	1	4	12	22
3	6	2	9	35	

Q. Seeking shelter in the foliage.

0	0	0	2	4	6
0	0	0	0	3	3
0	1	0	0	3	4
0	1	0	2	10	

V. Unmoving; pressed against the wall of the cage.

7	3	2	0	4	16
3	3	2	0	1	9
4	2	3	4	3	16
14	8	7	4	8	

W. Unmoving; free standing with spread limbs.

10	8	7	4	6	35
13	10	4	4	9	40
13	9	7	8	12	49
33	27	18	16	27	

X. Reflex immobility.

0	0	1	0	4	5
1	1	2	1	5	9
2	3	0	3	1	9
3	4	3	4	10	

Y. Standing vertically in one corner of the cage.

3	2	2	0	5	12
6	3	3	1	0	13
3	3	3	2	6	17
12	8	8	3	11	

Z. Moving, but rapidly becoming still as in V, W or X.

0	0	0	1	1	2
2	1	0	0	4	7
1	2	1	2	2	8
3	3	1	3	7	

The numbers in these grids represent the numbers of individuals showing each particular form of behaviour. There were 20 animals in the colony and each treatment was given three times, so that the highest number which could appear within the grid is 60.

It can be seen that the commonest form of behaviour was swaying, though even at its highest (30°C. and medium air speed) less than 30% of individuals gave this response. If Rupprecht is correct in his belief that swaying is a temperature control mechanism, then one would expect the swaying response to increase with increasing temperature, yet the grids show clearly that swaying decreases above 30°C.; similarly one might expect to find that swaying was less necessary at higher wind speeds yet the grids show that the response is effectively independent of air speed.

The colony was also subjected to human breath, which elicited eleven of the categories of response as follows:

A 6, B 1, D 14, E 12, G 3, H 1 I 8, K 11, L 4, M 2, N 1

All individuals performed some form of movement, and this time 41% of the responses were some form of swaying.

Reference

Rupprecht, R. 1971. Bewegungsmimikry bei *Carausius morosus* Br. (Phasmida). *Experientia*, **27**: 1437-1438.